

A Watershed Model for the South Fork Flathead River Basin Upstream from Hungry Horse Dam, Montana

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The Bureau of Reclamation (BOR) plans to develop a water-resource management model for the Clark Fork of the Columbia River basin to help optimize reservoir operations to meet increasing Montana water needs while still fulfilling downstream requirements for power generation and instream flow. As a first phase for this work, the U.S. Geological Survey (USGS) is assisting the BOR with development of a watershed model for the South Fork Flathead River, upstream from Hungry Horse Dam. The BOR plans to use this model to estimate daily values of unregulated streamflow at selected locations in the South Fork Flathead River basin.

The watershed model will be constructed using the USGS Modular Modeling System (MMS), an integrated system of computer software that provides a framework for the development and application of models to simulate different water, energy, and biogeochemical processes. For this study, MMS will link process modules from the USGS Precipitation-Runoff Modeling System (PRMS) to construct the watershed model. PRMS is a distributed watershed model that simulates precipitation- and snowmelt-driven movement of water through a basin via overland flow, interflow, and baseflow. The basin hydrologic response can be simulated at a daily or more frequent time step. Development of the PRMS model involves dividing the basin of interest into hydrologically homogeneous subunits. Digital-data layers for land use, soils, geology, and topography for each of these subunits are combined in a geographic information system (GIS); data from these layers are extracted for the PRMS model using a USGS GIS interface. In addition to the digital geospatial data, inputs to the PRMS model include daily precipitation, air temperature, solar radiation, and various channel hydraulic characteristics. The PRMS model will be calibrated and then tested by simulating daily streamflow and snowpack characteristics and comparing the results with observed data. After calibration, the PRMS model can be used to simulate the hydrologic response of the basin for various climatic scenarios.

MMS will be linked with a hydrologic database which in turn will connect with Riverware, the river-and-reservoir management model to be constructed and used by the BOR. These models will be part of the BOR's Decision Support System (DSS) for the South Fork Flathead River basin. This DSS will allow the BOR to estimate hydrologic conditions and run-off volumes in the South Fork Flathead River basin using the most up-to-date information, and will help BOR to efficiently operate the Hungry Horse Dam meet flow requirements throughout the basin.